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Mortality: Overview, 2008 and 2009

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0[s]	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
[p]	preliminary
[r]	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
[E]	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

Mortality: Overview, 2008 and 2009

This article focuses on Canadian mortality patterns in 2008 and 2009, including trends by region, age (including infant mortality) and sex.

Death counts and crude death rate

Following a slight increase in the number of deaths in Canada between 2007 (235,217) and 2008 (238,617), the total number of deaths decreased slightly to 238,418 in 2009 (Table 1). The slight decrease in deaths between 2008 and 2009 marks the third occurrence of a year-to-year decline since 1999.

With comparable vital statistics dating back to 1926, the number of deaths has generally increased over time in Canada. On the other hand, the crude death rate (the number of deaths per 1,000 persons) has fluctuated around 7.0 per 1,000 since the 1980s, following decreases between the 1950s and 1970s (Figure 1). Recently, the crude death rate increased slightly from 7.1 in 2007 to 7.2 in 2008, a level last observed in 1999. In 2009, however, the crude death rate returned to 7.1 per 1,000.

The increase in the number of deaths over time can be attributed mostly to population growth but also to population aging. As the age structure of the population becomes older, a relatively larger proportion of the total population is found in the older age groups which experience higher rates of mortality.

Following the national pattern, most of the provinces and territories experienced an increase in their crude death rates between 2007 and 2008, followed by a decrease in rates between 2008 and 2009. Quebec and Ontario's

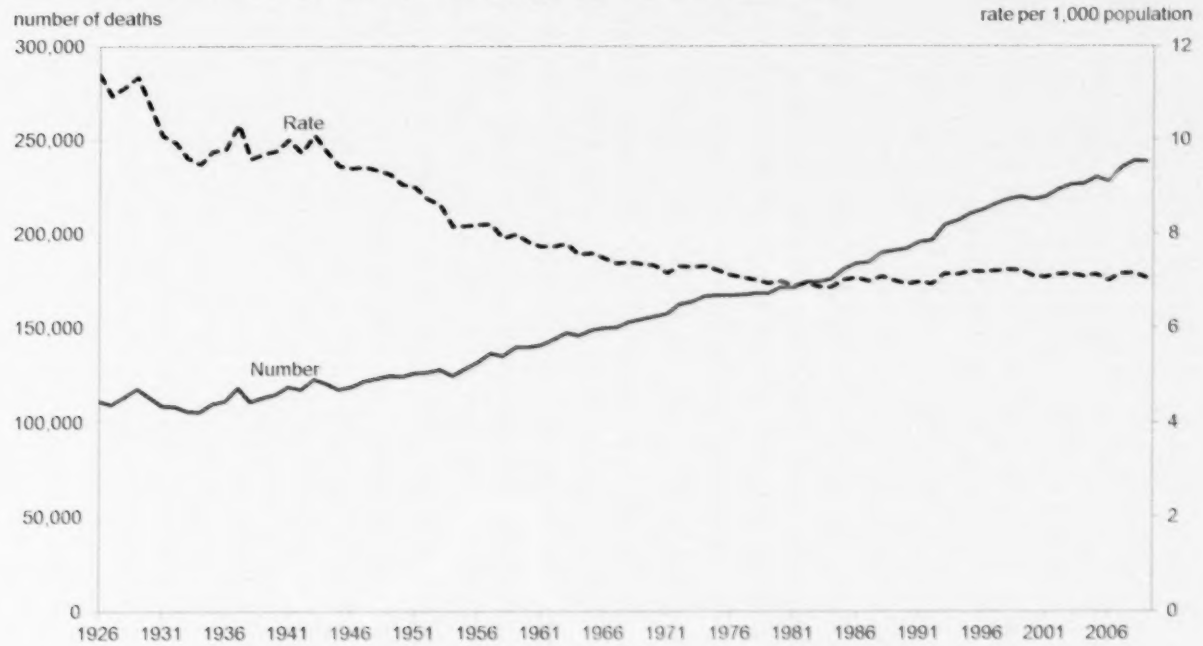
Table 1
Number of deaths and crude death rate per 1,000 population, Canada, provinces and territories, 1981 to 2009

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nt.	Unknown	Canada
								number							
1981	3,230	992	6,958	5,139	42,684	62,838	8,648	7,523	12,823	19,857	141	196	..	0	171,029
1986	3,540	1,121	7,255	5,458	46,892	67,865	8,911	8,061	13,560	21,213	113	235	..	0	184,224
1991	3,798	1,188	7,255	5,469	49,121	72,917	8,943	8,098	14,451	23,977	114	237	..	1	195,569
1996	3,928	1,268	7,751	5,896	52,336	79,099	9,497	8,765	16,391	27,536	120	272	..	21	212,880
2001	4,151	1,160	7,879	6,062	54,194	81,214	9,734	8,740	17,579	28,353	134	163	123	52	219,538
2002	4,183	1,236	7,997	6,096	55,534	82,234	9,849	8,906	18,234	28,883	147	169	127	8	223,603
2003	4,281	1,183	8,064	6,257	54,927	84,207	9,867	9,007	18,585	29,320	133	202	134	2	226,169
2004	4,308	1,223	8,241	6,247	55,624	83,142	9,903	8,844	18,675	29,923	166	153	121	14	226,584
2005	4,486	1,118	8,273	6,175	55,787	85,591	9,856	8,850	19,288	30,227	164	148	115	54	230,132
2006	4,493	1,172	8,088	6,010	54,240	84,524	9,774	9,054	19,540	30,688	178	182	129	7	228,079
2007	4,505	1,147	8,353	6,324	56,521	87,340	9,958	9,062	20,202	31,308	192	174	129	2	235,217
2008	4,539	1,201	8,220	6,450	57,106	88,041	10,073	9,243	21,079	32,095	198	201	147	24	238,617
2009	4,391	1,268	8,227	6,366	57,769	88,468	9,972	8,972	20,987	31,440	201	186	162	9	238,418
								rate per 1,000							
1981	5.6	8.0	8.1	7.3	6.5	7.1	8.4	7.7	5.6	7.0	5.9	4.1	..	...	6.9
1986	6.1	8.7	8.2	7.5	7.0	7.2	8.2	7.8	5.6	7.1	4.6	4.3	..	...	7.1
1991	6.6	9.1	7.9	7.3	7.0	7.0	8.1	8.1	5.6	7.1	3.9	6.1	..	...	7.0
1996	7.0	9.3	8.3	7.8	7.2	7.1	8.4	8.6	5.9	7.1	3.8	6.5	..	...	7.2
2001	8.0	8.5	8.5	8.1	7.3	6.8	8.5	8.7	5.8	7.0	4.4	4.0	4.4	...	7.1
2002	8.1	9.0	8.6	8.1	7.5	6.8	8.5	8.9	5.8	7.0	4.8	4.1	4.4	...	7.1
2003	8.3	8.6	8.6	8.3	7.3	6.9	8.5	9.0	5.8	7.1	4.3	4.7	4.6	...	7.1
2004	8.3	8.9	8.8	8.3	7.4	6.7	8.4	8.9	5.8	7.2	5.3	3.5	4.1	...	7.1
2005	8.7	8.1	8.8	8.3	7.4	6.8	8.4	8.9	5.8	7.2	5.1	3.4	3.8	...	7.1
2006	8.8	8.5	8.6	8.1	7.1	6.7	8.3	9.1	5.7	7.2	5.5	4.2	4.2	...	7.0
2007	8.9	8.3	8.9	8.5	7.4	6.8	8.3	9.1	5.8	7.3	5.9	4.0	4.1	...	7.1
2008	9.0	8.6	8.8	8.6	7.4	6.8	8.4	9.1	5.9	7.3	6.0	4.6	4.7	...	7.2
2009	8.6	9.0	8.7	8.5	7.4	6.8	8.2	8.7	5.7	7.0	6.0	4.3	5.0	...	7.1

Notes: Deaths for which the province or age of death was unknown were prorated using the observed distribution.
Nunavut is included in the Northwest Territories before 2001.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1981 to 2009, Survey 3233 and Demography Division, demographic estimates.

Figure 1
Number of deaths and crude death rate per 1,000 population, Canada, 1926 to 2009



Note: Deaths for which the province or age of death was unknown were prorated using the observed distribution.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1926 to 2009, Survey 3233 and Demography Division, demographic estimates.

crude death rates remained unchanged between 2007 and 2009. Among the provinces and territories, Nova Scotia alone experienced consecutive declines in its crude death rate in both the 2007 to 2008 and 2008 to 2009 periods. The slightly lower crude death rate in Nova Scotia may relate to the fact that between 2007 and 2009, the proportion of the province's population that was aged 65 years and older grew slightly, while the age-specific mortality rates attributed to the population aged 65 years and older declined.[1]

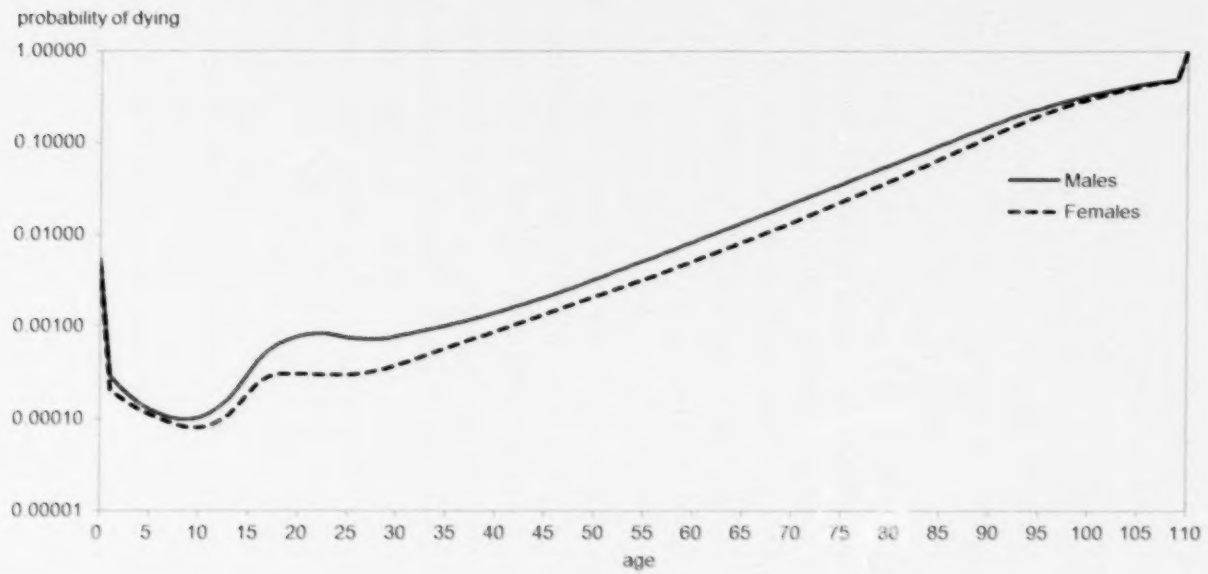
Differences in mortality by age and sex

Over the lifespan, mortality rates follow a pattern similar to a checkmark shape: the mortality rate is higher in the first year of life; mortality rates then decline to their lowest levels in childhood and slowly increase throughout adulthood, reaching their highest levels at the very oldest ages (Figure 2). As in the past, in both 2008 and 2009, females held lower mortality rates than males at all ages. This nearly ubiquitous gap in mortality between the sexes has been observed throughout history and among many other species. The sex differential in mortality has been attributed to hormonal, evolutionary, behavioural and socio-cultural differences between males and females, among other factors.

While the gap in mortality between the sexes is consistent across the lifespan, it varies in magnitude at different ages. In childhood, the gap between the sexes is minimal, while it is most pronounced in youth and young adulthood. Throughout middle age, mortality differences by sex slowly decline, and at older ages, the differential between the sexes reaches its lowest levels.

1. Nova Scotia's average mortality rate for ages 65 years and older declined from 46.7 per 1,000 in 2007 to 44.9 per 1,000 in 2008 to 43.9 per 1,000 in 2009. Source: Statistics Canada, Canadian Vital Statistics, Deaths Database, 2007 to 2009, Survey 3233 and Demography Division, demographic estimates.

Figure 2
Probability of dying by age and sex, Canada, 2007/2009 period



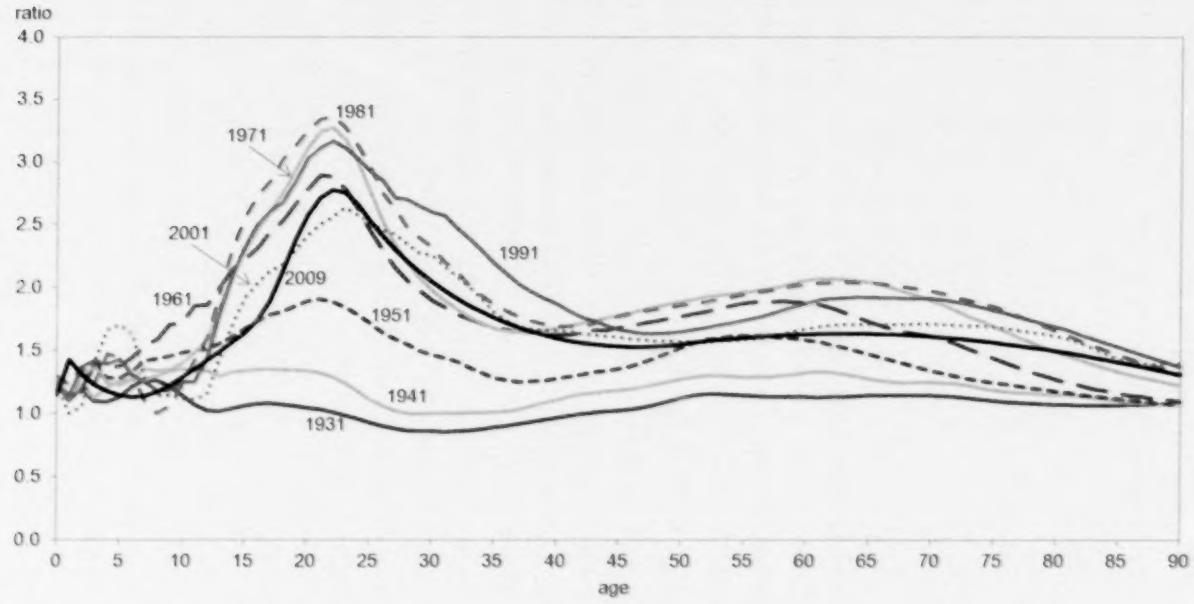
Notes: Deaths for which the province or age of death was unknown were prorated using the observed distribution.
Age 110 includes age 110 and older.
Source: Statistics Canada, Canadian Vital Statistics, Deaths Database, 2007 to 2009, Survey 3233.

The elevated gap in mortality rates for men compared to women in their late teens and early twenties is a pattern which developed in the latter half of the twentieth century. Figure 3 displays the male to female ratio of the probability of death by age at various points over the last 80 years. It can be seen that in 1931, the ratio was close to one for people in their late teens and early twenties meaning that young men and women had a similar probability of death. In fact, at ages 20 to 49, women actually had a higher probability of death than men in 1931. This pattern was mainly due to higher maternal mortality during this era; women had a higher risk of death due to complications related to childbearing than is currently the case.

The elevated risk of death for males relative to females in young adulthood began to emerge as a pattern in the 1950s and reached its highest levels in the late 1970s and early 1980s. In 1976, for example, 22 year-old men had a probability of death that was 3.5 times higher than that of women of the same age. This elevated risk of death for young men is mostly due to accidental and violent deaths from motor vehicle accidents, suicide or homicide.[2] Since the 1980s, while still present, there has been a reduction in the sex differential in the probability of death in young adulthood, a result of the fact that males have made greater improvements in mortality (that is, fewer deaths) than women with regard to accidents and violence in recent years.[3] That said, between 2001 and 2009, the male to female ratio for mortality actually became higher at ages 20 to 25, suggesting that the differential in mortality among young men and women will be a continuing trend for some time.

2. Milan, A. and L. Martel. 2008. "Mortality", *Report on the Demographic Situation in Canada: 2005 and 2006*, Statistics Canada catalogue no. 91-209-X.
3. Trovato, F. and M.N. Lalu. 1996. "Causes of death responsible for the changing sex differential in life expectancy between 1970 and 1990 in thirty industrialized nations", *Canadian Studies in Population*, volume 22, pages 99 to 126.

Figure 3
Ratio of males to females for the probability of dying, Canada, selected years



Notes: Each year of the figure refers to a 3-year period of which the stated year lies in the middle. For example, "1931" refers to the 1930 to 1932 period. The exception is 2009, which refers to the 2007 to 2009 period.

Deaths for which the province or age of death was unknown were prorated using the observed distribution.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1931 to 2009, Survey 3233 and Demography Division, demographic estimates.

Between 1981 and 2009, a decline also occurred in the sex ratio of the probability of death in middle adulthood (ages 45 to 69). This trend could be partly due to the fact that the behaviour of women (and associated risks of death) has become more similar to that of men over the last 40 years, particularly in the case of smoking behaviours.[4]

Regional differences in age-specific mortality

Across the provinces and territories, differences can be found in age-specific mortality rates, particularly among adolescents and young adults. As seen in Table 2, Nunavut experienced considerably higher mortality rates among young adults compared to the Canadian average. For example, in 2009, Nunavut's mortality rate for males aged 15 to 19 was twelve times greater than the male Canadian average at those ages (6.0 versus 0.5 per 1,000 persons), while the comparable female mortality rate in Nunavut was over six times higher than the female Canadian average at that age (1.9 versus 0.3 per 1,000 persons). There is some evidence[5] that in recent years, among regions with a high proportion of Aboriginal residents, "premature mortality"[6] was twice as high in young adulthood (ages 15 to 24) compared to regions with a low proportion of Aboriginal residents, with injuries (mainly suicides and motor vehicle accidents) being the largest contributor to the relatively elevated number of deaths at younger ages.

4. Martel, L., A. Bélanger and J.-M. Berthelot. 2001. "Smoking and disability-free life expectancy in Canada", *Report on the Demographic Situation in Canada: 2001*, pp. 113 to 136. Ottawa, Statistics Canada catalogue no. 91-209-X.
5. Allard, Y.E., R. Wilkins and J.-M. Berthelot. 2004. "Premature mortality in health regions with high Aboriginal populations", *Health Reports*, volume 15(1), Statistics Canada catalogue no. 82-003.
6. Allard et al. (2004) measure premature mortality in terms of "potential years of life lost". This measure gives greater weight to deaths at younger ages compared with other summary indices of mortality.

Table 2

Age-specific mortality rates per 1,000 population by age group and sex, Canada, provinces and territories, 2009

Sex and age group	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
	per 1,000													
Males														
All ages	7.2	9.3	9.2	9.0	8.7	7.4	6.9	8.2	9.0	5.9	7.3	6.7	5.0	5.6
Less than one year	5.1	7.4	5.5	3.4	5.9	4.5	5.3	6.7	6.8	5.6	3.3	14.7	10.7	18.3
1 to 4 years	0.2	0.2	0.0	0.1	0.3	0.1	0.2	0.3	0.4	0.2	0.1	0.0	0.0	2.1
5 to 9 years	0.1	0.2	0.0	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	1.7
10 to 14 years	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.3	0.2	0.1	0.0	0.6	1.2
15 to 19 years	0.5	0.8	0.2	0.5	0.7	0.4	0.4	1.0	1.0	0.6	0.5	0.0	1.0	6.0
20 to 24 years	0.7	0.4	0.4	1.0	0.9	0.6	0.6	1.2	1.4	1.0	0.7	0.8	1.6	2.6
25 to 29 years	0.8	0.7	1.3	0.9	1.3	0.7	0.6	1.2	1.3	0.9	0.9	1.8	1.1	2.3
30 to 34 years	0.8	1.6	1.3	0.9	1.1	0.8	0.7	0.9	1.3	0.8	1.0	0.0	2.2	3.2
35 to 39 years	1.1	1.6	2.1	1.5	1.5	1.0	0.9	1.1	1.4	1.2	1.1	0.8	0.6	2.6
40 to 44 years	1.6	1.8	1.6	1.8	2.3	1.4	1.4	1.7	2.6	1.7	1.8	1.6	3.1	2.8
45 to 49 years	2.5	2.8	3.3	3.0	2.7	2.3	2.3	3.1	3.1	2.7	2.6	4.9	2.8	4.1
50 to 54 years	4.1	4.7	3.0	4.2	4.5	3.9	4.0	5.3	4.9	4.3	4.1	7.3	5.1	6.1
55 to 59 years	6.2	7.2	5.5	7.3	6.1	6.4	6.1	7.3	6.1	5.8	6.0	7.9	7.4	11.5
60 to 64 years	9.6	11.4	13.4	10.7	10.1	9.7	9.2	10.9	11.3	10.1	8.7	13.7	13.7	7.7
65 to 69 years	15.7	19.9	17.2	17.8	16.1	16.6	15.0	17.5	18.5	15.7	14.1	14.0	14.5	26.4
70 to 74 years	24.5	31.4	33.0	28.5	27.8	24.7	24.3	28.1	28.5	24.8	20.1	43.6	44.6	68.5
75 to 79 years	41.6	53.2	40.1	50.6	50.0	42.9	40.2	46.4	44.8	43.1	36.3	29.5	79.4	58.1
80 to 84 years	70.0	91.2	92.6	75.2	72.2	72.2	70.1	70.6	69.5	68.6	62.6	130.0	96.8	307.7
85 to 89 years	117.0	148.4	153.5	130.3	128.1	118.1	114.5	124.8	118.3	115.5	112.4	148.1	61.2	58.8
90 years and older	211.9	241.3	215.1	214.7	209.9	207.6	210.7	220.5	232.9	221.9	203.2	500.0	210.5	500.0
Females														
All ages	6.9	8.0	8.8	8.5	8.3	7.4	6.6	8.2	8.5	5.6	6.8	5.2	3.5	4.4
Less than one year	4.7	5.1	1.4	3.5	5.7	4.3	4.7	5.9	6.7	5.3	3.9	0.0	20.8	11.3
1 to 4 years	0.1	0.2	0.7	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.0	0.0	0.0
5 to 9 years	0.1	0.0	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	1.1	0.0	0.0
10 to 14 years	0.1	0.0	0.0	0.2	0.3	0.1	0.1	0.2	0.2	0.1	0.1	0.0	0.7	0.6
15 to 19 years	0.3	0.2	0.0	0.3	0.4	0.2	0.2	0.7	0.5	0.4	0.1	0.9	0.6	1.9
20 to 24 years	0.3	0.4	0.2	0.2	0.3	0.3	0.2	0.6	0.6	0.3	0.4	0.0	0.6	1.4
25 to 29 years	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.6	0.6	0.5	0.4	0.0	1.0	0.7
30 to 34 years	0.5	0.3	0.2	0.5	0.4	0.4	0.4	1.1	0.7	0.6	0.4	3.4	1.2	3.5
35 to 39 years	0.6	0.7	0.0	0.5	0.6	0.6	0.6	1.0	0.8	0.7	0.7	0.8	0.0	3.7
40 to 44 years	1.0	1.5	1.8	0.9	0.7	0.9	0.9	1.5	1.3	1.2	1.0	2.2	2.5	5.5
45 to 49 years	1.7	1.6	1.5	1.4	1.8	1.8	1.6	1.9	2.3	1.9	1.6	1.8	2.4	3.5
50 to 54 years	2.6	2.6	3.7	2.9	2.7	2.7	2.5	3.0	3.3	2.7	2.4	1.4	3.3	4.6
55 to 59 years	3.9	3.8	4.2	4.5	4.1	4.0	3.8	3.7	4.2	4.0	3.5	3.4	2.7	8.0
60 to 64 years	6.2	5.2	5.3	7.3	6.8	6.4	5.8	8.3	8.9	5.9	5.7	15.3	7.7	27.9
65 to 69 years	9.4	11.6	10.3	10.9	9.6	9.4	9.1	12.4	11.1	9.8	8.3	14.5	12.8	25.9
70 to 74 years	15.8	19.7	20.2	16.3	18.0	16.0	15.6	17.8	16.5	15.5	14.0	34.7	30.3	36.4
75 to 79 years	26.3	34.6	31.1	29.9	31.4	26.4	25.8	26.9	28.2	26.2	23.9	57.6	30.2	75.8
80 to 84 years	47.4	60.6	62.0	52.6	47.1	48.4	47.3	47.3	45.3	45.0	45.0	69.0	52.2	58.8
85 to 89 years	84.9	109.1	100.3	91.1	92.9	86.9	82.5	86.1	81.5	87.0	81.8	100.0	61.7	71.4
90 years and older	178.6	204.8	205.1	187.4	181.0	175.7	177.7	178.2	182.4	183.2	175.8	122.0	225.8	363.6

Note: Deaths for which the province or age of death was unknown were prorated using the observed distribution.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 2009, Survey 3233 and Demography Division, demographic estimates.

Infant mortality

The total number of infant deaths (the number of deaths occurring within the first year of life) increased slightly between 2007 and 2008, from 1,881 to 1,911 (Table 3). The infant mortality rate, however, remained unchanged at 5.1 deaths per 1,000 live births. The increase in the number of infant deaths was therefore mostly a result of an increase in the total number of births between the two years, from 367,864 births in 2007 to 377,886 births in 2008.

In 2009, the infant mortality rate decreased to 4.9 deaths per 1,000 live births; the lowest rate on record. The number of infant deaths also decreased slightly to 1,872 in 2009, despite the fact that the overall number of births increased by 3,000 between 2008 and 2009. The previous lowest infant mortality rate of 5.0 was observed in 2006, and since the mid-1990s, Canada's infant mortality rate has fluctuated between 5.0 and 6.0 deaths per 1,000 live births.

Table 3
Number and rate of infant mortality, Canada, provinces and territories, 1981 to 2009

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	Unknown	Canada
								number							
1981	98	25	139	114	807	1,073	191	203	452	424	8	28	..	0	3,562
1986	65	13	104	81	604	969	157	157	393	355	12	28	..	0	2,938
1991	56	13	69	58	578	953	111	126	285	298	6	20	..	0	2,573
1996	38	8	59	40	396	802	104	112	236	237	0	19	..	0	2,051
2001	23	10	50	31	349	713	98	68	210	168	3	3	12	1	1,739
2002	21	2	36	27	346	681	98	67	283	183	3	7	8	0	1,762
2003	23	7	49	29	322	692	111	76	265	170	2	4	15	0	1,765
2004	23	6	40	30	342	735	97	74	236	175	4	0	12	1	1,775
2005	28	3	34	28	353	745	94	99	286	183	0	3	7	0	1,863
2006	24	3	34	28	415	674	88	75	238	171	3	7	10	1	1,771
2007	34	7	29	31	379	723	111	77	296	176	3	3	12	0	1,881
2008	25	3	32	24	379	753	101	85	317	166	2	7	13	4	1,911
2009	31	5	31	43	389	705	100	96	284	161	3	11	13	0	1,872
								rate per 1,000							
1981	10.8	13.2	11.5	10.9	8.5	8.8	11.9	11.8	10.6	10.2	14.9	21.5	..	...	9.6
1986	8.5	6.7	8.4	8.3	7.1	7.2	9.2	9.0	9.0	8.5	24.8	6.6	..	...	7.9
1991	7.8	6.9	5.7	6.1	5.9	6.3	6.4	8.2	6.7	6.5	10.6	4.3	..	...	6.4
1996	6.6	4.7	5.6	4.9	4.6	5.7	6.7	8.4	6.2	5.1	0.0	2.6	..	...	5.6
2001	4.9	7.3	5.6	4.3	4.7	5.4	7.0	5.5	5.6	4.1	8.7	4.9	16.9	...	5.2
2002	4.5	1.5	4.2	3.8	4.8	5.3	7.1	5.7	7.3	4.6	8.8	11.0	11.0	...	5.4
2003	5.0	4.9	5.7	4.1	4.4	5.3	8.0	6.3	6.6	4.2	6.0	5.7	19.8	...	5.3
2004	5.1	4.3	4.6	4.3	4.6	5.5	7.0	6.2	5.8	4.3	11.0	0.0	16.1	...	5.3
2005	6.2	2.2	4.0	4.1	4.6	5.6	6.6	8.3	6.8	4.5	0.0	4.2	10.0	...	5.4
2006	5.3	2.1	4.0	4.0	5.1	5.0	6.0	6.1	5.3	4.1	8.2	10.2	13.4	...	5.0
2007	7.5	5.0	3.3	4.3	4.5	5.2	7.3	5.8	6.0	4.0	8.5	4.1	15.1	...	5.1
2008	5.1	2.0	3.5	3.2	4.3	5.4	6.5	6.2	6.2	3.8	5.4	9.7	16.2	...	5.1
2009	6.3	3.4	3.4	5.8	4.4	5.0	6.3	6.7	5.5	3.6	7.8	15.5	14.8	...	4.9

Notes: Deaths for which the province or age of death was unknown were prorated using the observed distribution.
Nunavut is included in the Northwest Territories before 2001.

Source: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1981 to 2009, Survey 3233.

The relative stability of Canada's infant mortality rate over the last twenty years following a long period of decline could reflect the fact that infant mortality is approaching a "natural limit"; though several other countries have posted lower rates in recent years.[7] This stabilization could also partly be a result of several trends in the characteristics of births over the past few decades. The percentage of preterm and low birth weight births have been increasing since the mid-1980s, in part due to increased use of assisted reproductive therapies, which are linked to increased incidence of multiple births. Multiple births are a well-known risk factor for infant mortality, especially among older mothers.[8] Low birth weight is also found to be more common among the youngest and oldest-aged mothers, and the proportion of mothers over the age of 40 has increased in recent years.[9] Additionally, progress in perinatal care may have actually led to proportionally more low-weight live births holding higher mortality risks that formerly would have ended in miscarriage or stillbirth.[10] Finally, it has been suggested that an increased recognition of registration requirements in recent years may have led to an increase in the registration of extremely low birth weight babies in Canada, which hold a high risk of death in the first year of life.[11]

7. Canada's infant mortality rate was above the Organisation for Economic Co-operation and Development (OECD) average for 2008 (4.6 deaths per 1,000 live births), and considerably higher than the three OECD countries with the lowest infant mortality rates: Luxembourg (1.8), Slovenia (2.1) and Iceland (2.5). Note that some international variation in infant mortality rates may be due to differences among countries in the definition of live children following birth. Source: OECD. 2011. "Infant mortality", *Society at a Glance 2011: OECD Social Indicators*, OECD Publishing.

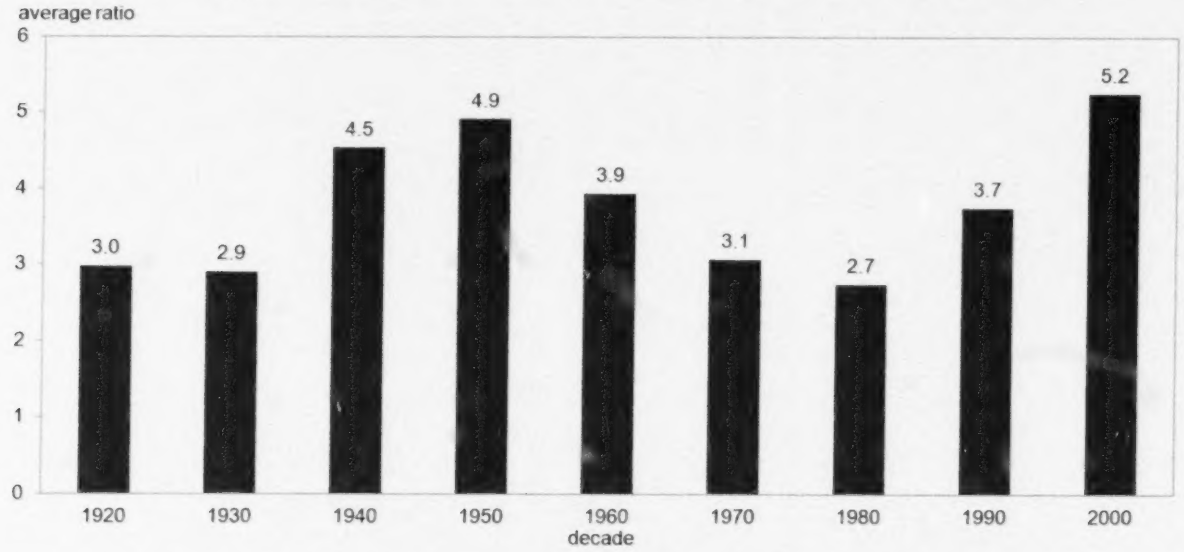
8. Matthews, T.J. and M.F. MacDorman. 2007. "Infant mortality statistics from the 2004 period linked birth/infant death data set", *National Vital Statistics Reports*, volume 55, number 14.

9. Statistics Canada. 2013. "Fertility: Overview 2009 to 2011", *Report on the Demographic Situation in Canada*, Statistics Canada catalogue no. 91-209-X.

10. Nault, F. 1997. "Narrowing mortality gaps, 1978 to 1995", *Health Reports*, volume 9(1), Statistics Canada catalogue no. 82-003-XPB.

11. Public Health Agency of Canada. 2008. *Canadian Perinatal Health Report*, Ottawa.

Figure 4
Average ratio of the highest to the lowest provincial/territorial annual infant mortality rate, by decade, Canada



Notes: Deaths for which the province or age of death was unknown were prorated using the observed distribution.
Each year in the x-axis refers to the 10 year-period starting with that year. For example, "2000" refers to the period 2000 to 2009. The exception is "1920", which refers to the period 1921 to 1929.
If Nunavut is excluded from the calculation for the 2000s, the ratio would be 3.8 instead of 5.2.
Source: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1921 to 2009, Survey 3233.

Among the provinces and territories, Nunavut and the Northwest Territories held the highest infant mortality rates in the country in both 2008 (16.2 and 9.7 deaths per 1,000 live births, respectively) and 2009 (14.8 and 15.5, respectively). In comparison, Prince Edward Island held the lowest infant mortality rate at 2.0 deaths per 1,000 live births in 2008 and, along with Nova Scotia, 3.4 in 2009. Notably, the smaller populations in these jurisdictions lead to annual variations of a greater magnitude than those with larger populations.

The level of difference in infant mortality rates across the provinces and territories has varied over the last ninety years. As seen in Figure 4, regional differences in the infant mortality rate generally increased from the 1920s to the 1950s, with the highest infant mortality rate among the provinces and territories in the 1950s being on average approximately five times greater than that of the lowest. Coinciding with the implementation of the health care system in all regions of Canada, discrepancies between the provinces and territories decreased throughout the 1960s to 1980s, with the ratio between the highest and lowest infant mortality rate decreasing to an average of 2.7 in the 1980s.

In more recent years, coinciding with the introduction of Nunavut territory, variation in infant mortality rates has widened. In 2009, the highest provincial/territorial infant mortality rate was nearly five times that of the lowest (3.4 deaths per 1,000 live births for Prince Edward Island and Nova Scotia versus 15.5 for the Northwest Territories). During the decade of the 2000s, the average ratio between the highest infant mortality rate among the provinces and the territories and the lowest was 5.2; nearly double the average ratio experienced in the 1980s.[12] This widened discrepancy is driven largely by the different evolution of infant mortality for the provinces compared to the territories over the last decade. Between 2000 and 2009, the ten provinces experienced on average a reduction of 0.5% in

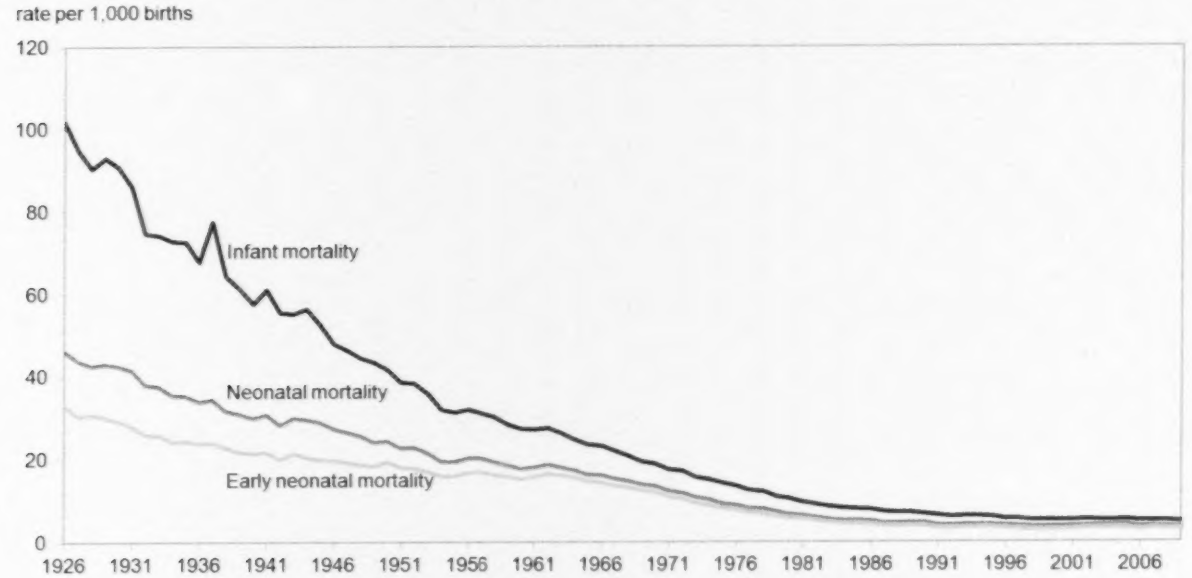
12. If Nunavut is excluded from the calculation for the 2000s, the ratio would be 3.8 instead of 5.2.

their infant mortality rates, while the three territories show no evidence of any reduction. Differences in infant mortality across Canada have been linked to factors relating to the existing socio-economic, health, health care and environmental conditions in predominantly Inuit-inhabited areas of Northern Canada.[13 and 14]

The composition of infant mortality

The composition of infant mortality has changed substantially over the past ninety years. In 1926, most infant deaths in Canada (54.5%) occurred after the first month of life. Globally, as child mortality rates have declined, the proportion of deaths occurring before the age of four weeks has grown: On average, within developed regions of the world, 63% of infant mortality took place in the neonatal period (between 0 and 27 days) in 2000.[15] By 2009, three-quarters (75%) of infant deaths in Canada occurred in the first month of life (Figure 5). Despite the fact that it accounts for an increasing proportion of all infant mortality, Canada's neonatal mortality rate declined from 4.2 deaths per 1,000 live births in 2007 to 3.7 in both 2008 and 2009; the lowest neonatal mortality rate on record. Within neonatal mortality, the majority of deaths occur in the early neonatal period (in the first week of life): since 1954, early neonatal deaths have represented no less than 80% of all neonatal deaths.

Figure 5
Infant mortality rate, neonatal mortality rate and early neonatal mortality rate, Canada, 1926 to 2009



Notes: Deaths for which the province or age of death was unknown were prorated using the observed distribution.
Infant mortality refers to deaths of infants aged 0 to 364 days.
Neonatal mortality refers to deaths of infants aged 0 to 27 days.
Early neonatal mortality refers to deaths of infants aged 0 to 6 days.
Source: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1926 to 2009, Survey 3233.

13. The Inuvialuit region of the Northwest Territories, Nunavut, Nunavik (northern Quebec) and Nunatsiavut (northern coast of Labrador) from Luo, Z.C., S. Senécal, F. Simonet, E. Guimond, C. Penney and R. Wilkins. 2010. "Birth outcomes in the Inuit-inhabited areas of Canada", *Canadian Medical Association Journal*, volume 182(2), pages 235 to 242.
14. Joseph, K.S., L. Huang, S. Dzakpasu and C. McCourt. 2009. "Regional disparities in infant mortality in Canada: a reversal of egalitarian trends", *BioMedCentral Public Health*, volume 9:4.
15. World Health Organization. 2006. *Neonatal and perinatal mortality: Country, regional and global estimates*.

Life Expectancy

Life expectancy at birth was 78.4 years for males and 83.0 years for females in Canada for the period 2006/2008; an increase of 0.2 years for both males and females compared to 2005/2007 (Table 4). In the following 2007/2009 period, male and female life expectancy at birth increased slightly to 78.6 years and 83.1 years, respectively.

During the 2006/2008 period, females could be expected to live an additional 21.2 years after reaching the age of 65, while males could be expected to live an additional 18.2 years. In 2007/2009, female and male life expectancy at age 65 increased slightly to 21.4 and 18.3 years, respectively.

Table 4
Life expectancy by sex at selected ages, Canada, selected periods

Sex and age	1990/1992	1995/1997	2000/2002	2001/2003	2002/2004	2003/2005	2004/2006	2005/2007	2006/2008	2007/2009
	in years									
Males										
At birth	74.5	75.4	76.9	77.1	77.4	77.6	78.0	78.2	78.4	78.6
1 year	74.1	74.9	76.4	76.6	76.8	77.1	77.4	77.6	77.8	78.1
5 years	70.2	71.0	72.4	72.7	72.9	73.1	73.5	73.7	73.9	74.1
10 years	65.2	66.0	67.5	67.7	68.0	68.2	68.5	68.7	69.0	69.2
15 years	60.3	61.1	62.5	62.8	63.0	63.2	63.6	63.8	64.0	64.2
20 years	55.6	56.3	57.7	58.0	58.2	58.4	58.7	58.9	59.2	59.4
25 years	50.9	51.6	53.0	53.2	53.4	53.7	54.0	54.2	54.4	54.6
30 years	46.2	46.9	48.2	48.4	48.6	48.9	49.2	49.4	49.6	49.8
35 years	41.5	42.1	43.4	43.6	43.8	44.1	44.4	44.6	44.8	45.0
40 years	36.8	37.4	38.7	38.9	39.1	39.3	39.7	39.9	40.1	40.3
45 years	32.1	32.8	34.0	34.2	34.4	34.7	35.0	35.2	35.4	35.6
50 years	27.6	28.3	29.4	29.6	29.8	30.1	30.4	30.6	30.8	31.0
55 years	23.4	24.0	25.0	25.2	25.4	25.7	26.0	26.2	26.4	26.5
60 years	19.4	19.9	20.9	21.1	21.3	21.5	21.8	22.0	22.1	22.3
65 years	15.7	16.2	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.3
70 years	12.5	12.8	13.5	13.7	13.8	14.0	14.2	14.4	14.5	14.7
75 years	9.8	9.9	10.4	10.5	10.7	10.9	11.1	11.1	11.3	11.4
80 years	7.5	7.4	7.8	7.9	8.0	8.1	8.3	8.3	8.5	8.6
85 years	5.6	5.4	5.7	5.7	5.8	5.9	6.0	6.0	6.1	6.2
90 years	4.2	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3	4.4
95 years	3.1	2.8	2.8	2.8	2.8	2.9	2.9	3.0	3.0	3.1
100 years	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.3
Females										
At birth	80.9	81.1	82.0	82.1	82.2	82.4	82.7	82.8	83.0	83.1
1 year	80.3	80.6	81.4	81.5	81.7	81.8	82.1	82.2	82.4	82.5
5 years	76.4	76.6	77.4	77.6	77.7	77.9	78.1	78.2	78.4	78.6
10 years	71.5	71.7	72.5	72.6	72.7	72.9	73.1	73.3	73.4	73.6
15 years	66.5	66.8	67.5	67.6	67.8	68.0	68.2	68.3	68.5	68.6
20 years	61.7	61.9	62.6	62.7	62.9	63.0	63.3	63.4	63.6	63.7
25 years	56.8	57.0	57.7	57.8	58.0	58.1	58.4	58.5	58.7	58.8
30 years	51.9	52.1	52.8	52.9	53.1	53.2	53.5	53.6	53.8	53.9
35 years	47.0	47.2	47.9	48.0	48.2	48.3	48.6	48.7	48.9	49.0
40 years	42.2	42.4	43.1	43.2	43.3	43.5	43.7	43.9	44.0	44.2
45 years	37.4	37.6	38.3	38.4	38.6	38.7	39.0	39.1	39.2	39.4
50 years	32.8	32.9	33.6	33.7	33.9	34.0	34.3	34.4	34.5	34.7
55 years	28.3	28.4	29.1	29.2	29.3	29.4	29.7	29.8	30.0	30.1
60 years	23.9	24.0	24.6	24.8	24.9	25.0	25.2	25.3	25.5	25.6
65 years	19.8	19.9	20.4	20.5	20.6	20.8	21.0	21.1	21.2	21.4
70 years	16.0	16.0	16.5	16.6	16.7	16.8	17.0	17.1	17.2	17.3
75 years	12.6	12.5	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6
80 years	9.6	9.4	9.7	9.8	9.8	9.9	10.1	10.1	10.2	10.3
85 years	7.0	6.8	7.0	7.0	7.1	7.2	7.3	7.3	7.4	7.5
90 years	5.0	4.8	4.8	4.8	4.9	5.0	5.0	5.0	5.1	5.2
95 years	3.4	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.5	3.5
100 years	2.4	2.2	2.2	2.2	2.2	2.2	2.3	2.4	2.4	2.5

Note: Deaths for which the province or age of death was unknown were prorated using the observed distribution.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1990 to 2009, Survey 3233 and Demography Division, demographic estimates.

Among the provinces and territories, British Columbia experienced the highest life expectancy at birth for both females and males in the 2006/2008 and the 2007/2009 periods, as has been the case for several consecutive periods. The variation in life expectancy at birth among the provinces and territories was larger among males (11.4 years) than among females (9.7 years) in the 2007/2009 period. For both sexes, the lowest life expectancies were found in Nunavut, where females held a life expectancy at birth of 74.0 years and males 68.0 years.

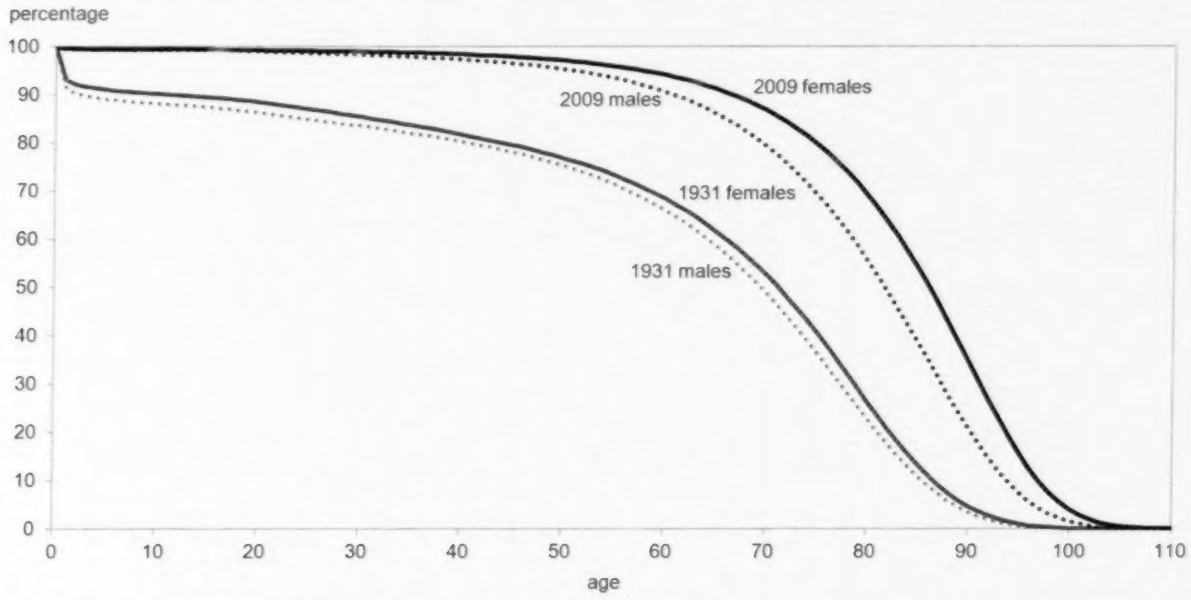
The differential in life expectancy at birth between the sexes in Canada increased from the 1930s to the 1970s and has been declining fairly steadily since. This gap has narrowed from its peak of 7.5 years in 1978[16] to 4.5 years in the 2007/2009 period. Regionally, the gap between the sexes in the 2007/2009 period was largest in Nunavut (6.0 years) and smallest in British Columbia (4.3 years).

The life expectancies of Canadian males and females in 2009 were both above the average of OECD countries in the same year, that being 76.7 years for males and 82.2 years for females.[17] Canadian male life expectancy was similar to that of Spain (78.6 years) and Norway (78.7 years), with Switzerland having the highest male life expectancy, 79.9 years. For females, Canada's life expectancy was similar to that of Austria and Norway (both 83.2 years), with Japan holding the highest female life expectancy in 2009 at 86.4 years.

The rectangularization of mortality

In many countries, a pattern referred to as "rectangularization" or "compression" of mortality has appeared. Rectangularization of mortality occurs when the proportion of persons surviving to advanced ages increases. As a result, the survival curve (Figure 6) increasingly takes on a rectangular shape as proportionally more mortality occurs

Figure 6
Proportion of persons in a synthetic cohort surviving from birth to age x, Canada, 1931 and 2009, by sex



Notes: "2009" refers to the period 2007 to 2009.
Deaths for which the province or age of death was unknown were prorated using the observed distribution.

Sources: Statistics Canada, Canadian Vital Statistics, Deaths Database, 1930 to 2009, Survey 3233 and Demography Division, demographic estimates.

16. Nault, F. 1997. "Narrowing mortality gaps, 1978 to 1995", *Health Reports*, volume 9, number 1, Statistics Canada catalogue no. 82-003-XPB.
17. OECD. 2011. "Life expectancy", *OECD Factbook 2011-2012: Economic, Environmental and Social Statistics*, OECD Publishing.

at later and later ages. There is continuing debate as to whether complete rectangularization of mortality will eventually occur, meaning that all deaths would occur at roughly the same advanced age. This would imply a fixed, predetermined biological limit to human survival.

As seen in Figure 6, there is evidence that mortality is becoming increasingly compressed (occurring more and more at older ages) in Canada. In 1931, 91.3% of persons belonging to a synthetic cohort[18] remained alive from birth to age 1, compared to 99.5% of persons in 2009. Similarly, in 1931, approximately three-quarters (75.2%) of persons survived from birth to age 50, while by 2009, this proportion had increased to 95.3%. While the curves in 2009 are more rectangular in shape than in 1931, the substantial extension in the length of the 2009 curves compared to those of 1931 suggests that Canada is not yet approaching a theoretical upper limit to life expectancy of a population. Nonetheless, the shifting of the majority of deaths to advanced ages has important implications for health care demands and services, for the size and age structure of the labour force and resulting productivity, as well as for the quality of life among seniors.

18. The period life table is a mathematical model of the life history of a hypothetical, or synthetic, cohort rather than a real birth cohort. Thus, the survival rates produced displayed in Figure 6 represent a situation where a hypothetical cohort of 100,000 people experienced throughout their lives the age-specific mortality rates of a given year (here, 1931 or 2009).